Remarks/Arguments

Reconsideration and allowance of the above-referenced application are respectfully requested.

Claims 1-15 are pending. Claims 1 and 5 have been amended and new claims 8-15 have been added. Basis for the amendments to claims 1 and 5 can be found in various parts of the specification, including at page 9, line 28 to page 10, line 8. Basis for new claims 8 and 12 can be found in various parts of the specification, including at page 5, lines 5-11. Basis for new claims 9 and 13 can be found at page 10, lines 1-5 and in other parts of the specification. Basis for new claims 10-11 and 14-15 can be found at page 9, lines 13-14 and in other parts of the specification.

Claims 1-7 are rejected under 35 U.S.C. Sec. 103 as being unpatentable over U.S. Patent No. 3,240,204 (Von Wiesenthal) in view of U.S. Patent No. 5,823,769 (Joshi et al). The Office Action asserts that Von Wiesenthal discloses all of the features of the claims except for "firing the plurality of hearth burners with the combustion air and with less than the stoichiometric amount of fuel gas and injecting additional fuel gas into the radiant heating zone through the wall stabilizing fuel gas tips to thereby provide the stoichiometric quantity of fuel and thereby stage the combustion and prevent flame rollover." The Office Action further asserts that this feature is taught by Joshi et al. Reconsideration is requested.

The present application discloses a method and apparatus for preventing overheating of process heater coils in a pyrolysis heater. In the techniques disclosed herein, a low pressure zone is created along the walls. This draws the flame away from the central tubular coils containing process fluid. By preventing tube overheating, coking or carburization is prevented. Furthermore, the height of the recirculation zone is increased, resulting in usage of the surface area along a substantial portion of the length of the heating coils. These features are particularly useful in low NOx burners, as low NOx burners otherwise tend to have flame rollover at a relatively low point along the height of the coils and therefore tend to not utilize the surface area along the upper portion of the coils.

Independent claim 1 and 5 are directed to a heater having a plurality of hearth burners and a plurality of wall stabilizing fuel gas tips. The original form of claim 1 provided that the inclusion of the fuel gas tips acted to stage the combustion and "prevent flame rollover." This concept is now even more clearly described by the replacement of this term with the phrase "to create a low pressure zone at said walls." Claim 5 also has been amended to refer to "a low pressure zone at said walls." This feature is neither disclosed nor suggested by the cited references.

Von Wiesenthal is directed to a direct-fired pyrolysis heater with burners 47. There is no mention in this document of firing burners with combustion air and less than the stoichiometric amount of fuel gas.

Joshi is directed to a method of burner firing in a glass melting furnace. A process is disclosed for combustion of fuel in which the level of NOx emissions is reduced. There is no mention of a pyrolysis heater. The fuel and air are not mixed in this furnace in the same way as they are in the hearth burners described in the present application. There is no disclosure or suggestion in this document that the technology described therein could or should be combined with the pyrolysis heater technology of Von Wiesenthal. Thus, these two documents are not logically combined in the manner suggested by the Office Action.

Even if the teachings of Von Wiesenthal and Joshi were combined, they would not render obvious the claims of the present application. In the arrangement of Joshi, the supplemental burners are located in the port 11, not in the combustion chamber. In the embodiments shown in Figs. 7 and 8 of Joshi, the supplemental burners 25 are located upstream from the primary burners 20. It appears that some combustion takes place in the port 11. The supplemental burners of Joshi are intended to create an oxygen-deficient zone 29 in the initial primary flame zone to inhibit NO_x formation, and provide a flame with increased flame luminosity and coverage above the melt surface due to localized fuel-rich combustion in the oxygen-deficient region 29. In contrast, the pyrolysis heater of the present application is oxygen-rich at the upstream end of the combustion zone and thus the combustion temperature is less than the case where a close stoichiometric fuel air mixture is used in the primary zone.

Furthermore, the Joshi system does not inject fuel in the same manner as is provided in the present application. As indicated at col. 6, lines 10-41 of Joshi, in the embodiment shown in Fig. 8, primary burners 20 fire at an angle α_p to the port center line and in-line burners 25 fire at an angle α_i equal to about 90 degrees relative to the port side wall 19. In contrast, neither the hearth burners nor the wall stabilizing fuel gas tips recited in paragraphs c and d of claims 1 and 5 of the present application fire at an angle of 90 degrees relative to the side walls. Thus, Joshi does not make up for the deficiencies of Von Wiesenthal. Reconsideration is requested.

In view of the above, it is believed that this application is in condition for allowance and such a Notice is respectfully solicited.

Respectfully submitted,

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